

DISCOVERY OF THE FAMILY BLEPHARICERIDAE (DIPTERA) IN CUBA, INCLUDING THE DESCRIPTION OF A NEW SPECIES

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ABSTRACT. A member of the dipterous family Blephariceridae (Blepharicerinae, Apistomyiini) has been discovered on the island of Cuba. It is a new species, *Paltostoma palominoi*, from the Sierra Maestra, Santiago de Cuba Province. Although it shares some character states with *Paltostoma argyrocineta* and an unnamed species from Puerto Rico, its affinities are uncertain, with different stages bearing some similarities with both *Limonicola* and other special groups within *Paltostoma*. The larva, pupa, and adult male and female are described and figured.

RESUMEN. Se ha encontrado un miembro de la familia Blephariceridae de Diptera (Blepharicerinae, Apistomyiini) de la isla de Cuba. Es una especie nueva, *Paltostoma palominoi*, de la Sierra Maestra, Provincia Santiago de Cuba. A pesar de que algunos caracteres establecen su relación con *Paltostoma argyrocineta* y una especie no nombrada de Puerto Rico, sus afinidades son inciertas, pues los diferentes estadios muestran similitudes parciales con *Limonicola* y unos grupos de especies de *Paltostoma*. Se describen, y muestran figuras de la larva, pupa, macho, y hembra.

INTRODUCTION

Despite the considerable history of entomological research in Cuba, the family Blephariceridae was unknown until Garcés discovered a thriving population in the Sierra Maestra, Santiago de Cuba Province, in 1987 (Garcés et al., in press). The species proved to be new and is described here from material collected the following year.

Where not self-evident or labelled on figures herein, explanations for the terms used in this paper for morphological structures are explained by Hogue (1987; Hogue and Bedoya, in press). A new pupal character introduced below is the ratio of the anterior division of the body to the posterior division (HM/TA). The measurements are made along the dorsal midline; the anterior division (HM) from the front margin of the head to the rear of the scutum (scuto-metathoracic suture), and the posterior division (TA) from the front margin of the metathoracic tergite (scuto-metathoracic suture) to the terminus of the abdomen (Head-Mesothorax/meTathorax-Abdomen). All measurements in the description below are in millimeters.

Paltostoma palominoi Hogue and Garcés, new species

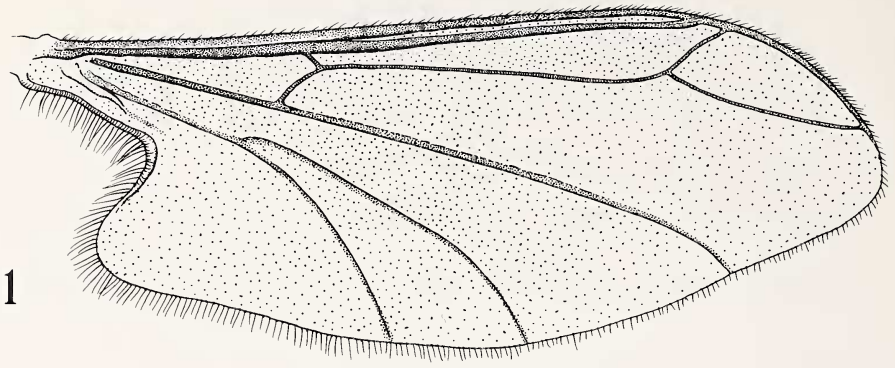
DESCRIPTION

MALE (Figs. 1-4, 7-10). Based on four teneral specimens (extracted from pupae, dissected, and mounted on slides) plus two mature specimens (including holotype), dissected and mounted on slides. *Coloration*: Indeterminable. Wing membrane hyaline. *Size*: A small blepharicerid. Measurements: wing length (N = 1) 3.5. Lengths of leg segments (N = 1 for femur-tarsus 1, N = 5 for tarsi 2-5):

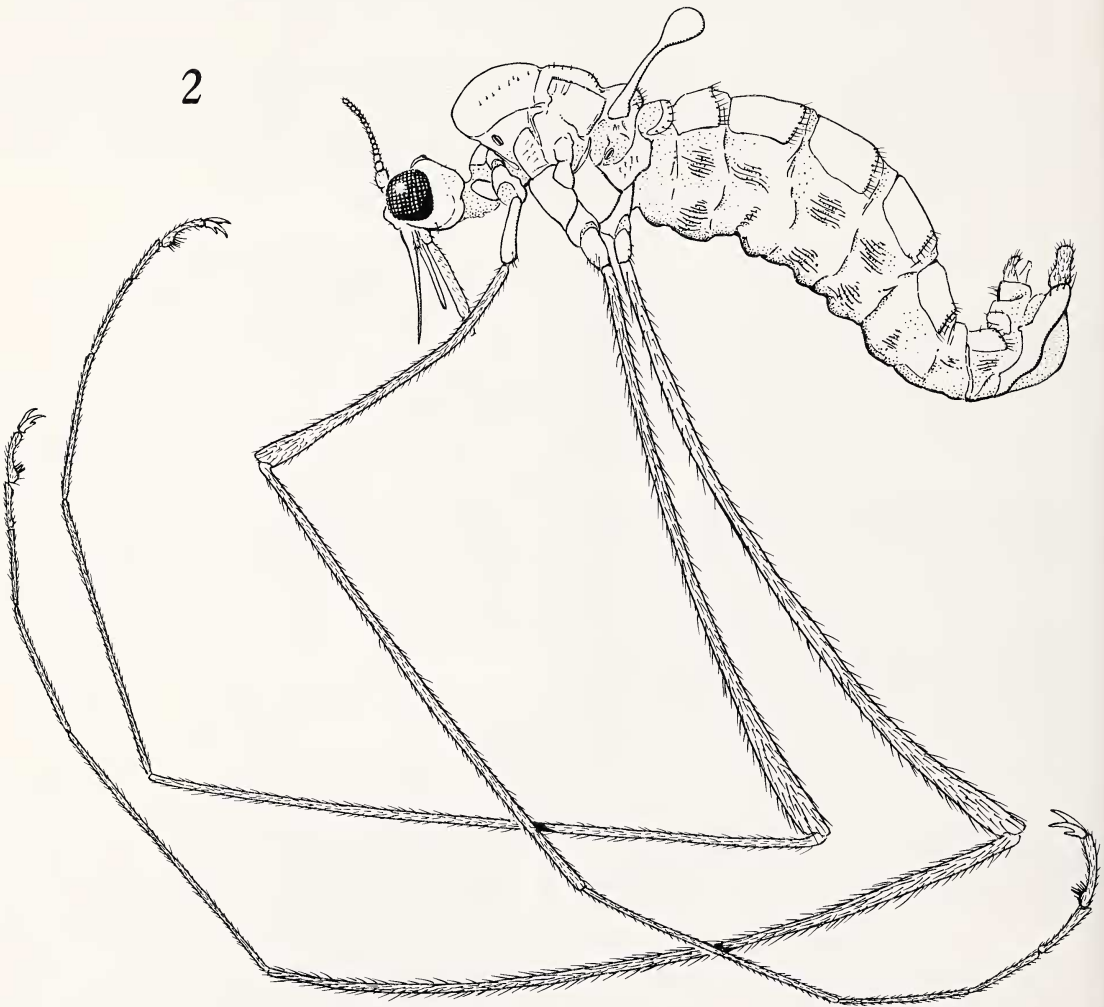
	fore leg	mid leg	hind leg
femur	1.4	2.5	2.9
tibia	2.3	2.7	3.1
tarsus 1	1.1	1.0	1.0
2	0.51 (0.48-0.55)	0.55 (0.50-0.58)	0.51 (0.49-0.56)
3	0.34 (0.31-0.37)	0.35 (0.30-0.38)	0.32 (0.29-0.36)
4	0.19 (0.18-0.20)	0.18 (0.17-0.19)	0.18 (0.16-0.19)
5	0.22 (0.21-0.23)	0.21 (0.20-0.24)	0.21 (0.20-0.24)

Head (Fig. 3). Semi-colocephalous type, dichoptic. Eyes disjunct dorsally, interocular distance about 0.3 head width; anterior eye margin entire. Mouthparts incompletely developed, proboscis short, labium length slightly less than head width; mandibles and hypopharynx completely absent; palpus very short, a single elongate segment, sensory pit absent. Antenna (Fig. 3) short (about same length as width of head), 14- (sometimes 13-) segmented, terminal segment sometimes partially fused, flagel-

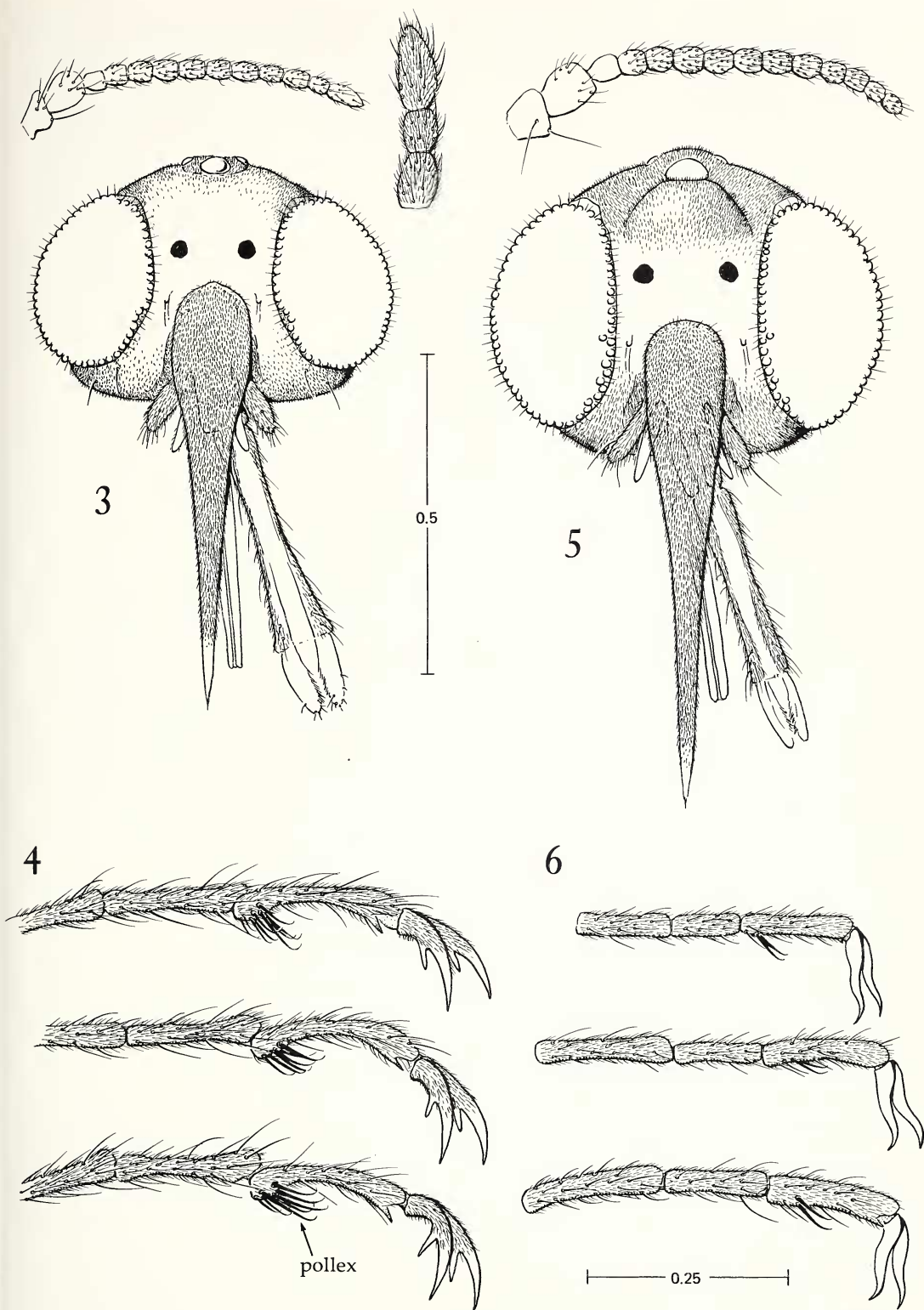
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Figures 1, 2. *Paltostoma palominoi*. 1. Right wing of male (dorsal view). 2. Adult male (left lateral view).



Figures 3–6. *Paltostoma palominoi*. 3. Head of male (frontal view) with antenna above (apical segments enlarged to right). 4. Terminal tarsal segments of male; fore (upper), mid (center), hind (lower). 5. Head of female (frontal view) with antenna above. 6. Terminal tarsal segments of female (lateral view), arrangement as for male.

lar segments submoniliform, ultimate segment longer (1.6) than penultimate, penultimate segment slightly diminutive, proportions of apical three segments: 1.0–0.9–1.4.

Sensilla. Setiform groups on head capsule and mouthparts as follows: clypeals numerous, minute, basal; occipitals few (7–8), scattered; genals few (1–2); postgenals and labrals absent; labials and labellars numerous, scattered throughout.

Thorax and Appendages (Figs. 1, 2, 4). Wing venation as in Figure 1, typical of *Paltostoma*. Anal angle of wing slightly produced, a small lobe. Legs long and slender, hind leg slightly stouter than others. Tibial spurs 0–0–0. Progressive proportions of leg segments: fore leg 1.6–0.5–0.5–0.7–0.6–1.2, mid leg 1.1–0.4–0.6–0.6–0.5–1.2, hind leg 1.1–0.3–0.5–0.6–0.6–1.2; basitarsus short in relation to tibia in all legs (0.3–0.5), especially hind leg (0.3). Tarsomeres 5 similar on all legs, curved, with pollex (basal group of several heavy setae); claw sickle-shaped, with strong subbasal tooth.

Sensilla. Setiform groups on thoracic sclerites as follows: acrostichals few, anterior only; dorso-central series complete; supraalars several (5–7), dorsal; prescutellars absent; scutellars numerous, generally distributed across sclerite, slightly more numerous laterad; preepisternals few (2–3), in ventral part; metapleurals several (5–7); suprametapleurals few (2–4).

Terminalia (Figs. 7–10). Genital capsule elongate. Cerci parallel to slightly divergent, a transverse sclerotization connecting bases; interlobular depression deep, broadly U-shaped; individual cercus elongate, slightly oblique, and curved gently ventrad. Inner arms of cerci convergent, apices widely separated. Walls of subanal pouch thin. Tegmen entirely soft and membranous, broadly rounded and finely spiculate apically, no medial recurved keel dorsally. Outer gonostylus large (length 0.8 width of genital capsule), an elongate, rectangular lobe, very slightly expanded and rounded apically. Inner gonostylus an elongate, porrect strap, apex projecting as a point laterally, inner margin and apex densely long-spiculate. Sperm sac broad, hemioval, anteriorly spiculate on inner wall, outer wall with fine striae dorsally. Piston a large, pear-shaped sac with spicules on inner walls anteriorly; apodeme absent; vasa deferentia joining laterally, at narrowest point. Neither ventral plate nor lateral tines present. Aedeagal rods short, walls thick basally and internal canal evident basally.

Sensilla. Epiandrium with several medium setiforms in a sparse transverse series. Cercus with numerous long setiforms generally, these more dense and longer medially. Setae of inner arm several to numerous (8–16), scattered basad, clustered distad. Outer gonostylus with medium setiforms general on ectal and ental surfaces, none concentrated into groups. Alveoliform sensilla of tergite X not apparent. Sternite X without apical setiforms.

FEMALE (Figs. 5, 6, 11). Based on four teneral specimens (extracted from pupae, dissected, and

mounted on slides) plus two mature specimens (including allotype), dissected and mounted on slides. **Coloration:** Indeterminable. Wing membrane hyaline. **Size:** A small blepharicerid. Measurements: wing length (N = 1) 3.5. Lengths of leg segments (N = 1 for femur–tarsus 1, N = 5 for tarsi 2–5):

	fore leg	mid leg	hind leg
femur	1.0	2.0	2.4
tibia	1.1	1.8	2.2
tarsus 1	0.5	0.8	0.9
2	0.22 (0.18–0.25)	0.36 (0.30–0.40)	0.38 (0.30–0.46)
3	0.14 (0.11–0.18)	0.20 (0.18–0.24)	0.20 (0.18–0.23)
4	0.14 (0.09–0.14)	0.13 (0.11–0.16)	0.14 (0.11–0.16)
5	0.17 (0.14–0.19)	0.17 (0.15–0.20)	0.17 (0.17–0.18)

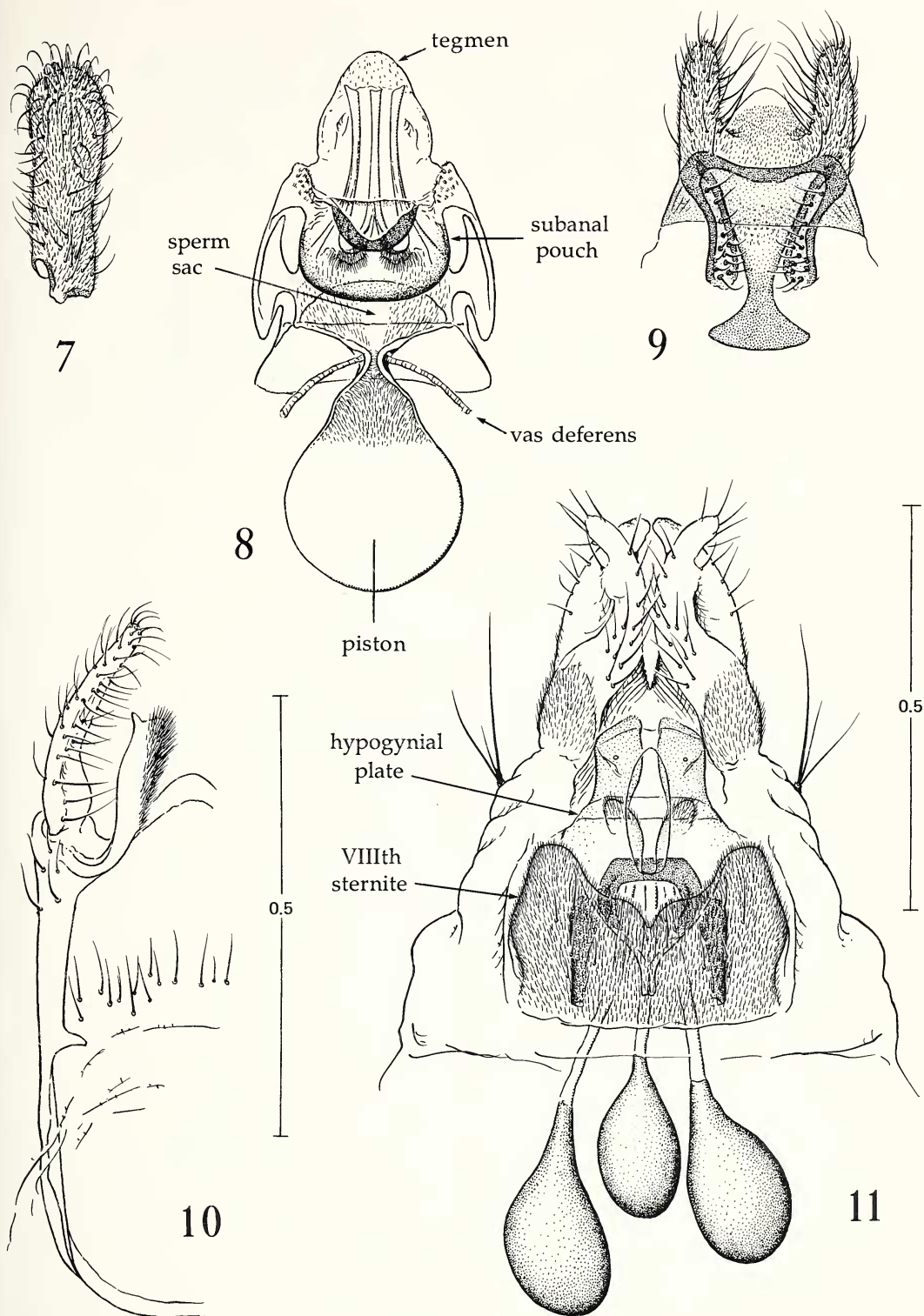
Head (Fig. 5). Virtually identical to that of male. Semi-colocephalous type, dichoptic. Eyes disjunct dorsally, interocular distance about 0.3 head width; anterior eye margin entire. Mouthparts incompletely developed, proboscis short, labium length slightly less than width of head; mandibles and hypopharynx completely absent; palpus very short, a single elongate segment, sensory pit absent. Antenna short (about same length as width of head), 14- (rarely 13-) segmented, some segments sometimes partially fused, flagellar segments submoniliform, ultimate segment equal to penultimate, proportions of apical three segments: 1.0–0.9–0.9.

Sensilla. Setiform groups on head capsule and mouthparts as follows: clypeals numerous, minute, basal; occipitals few (6–8), scattered; genals few (1–2); postgenals and labrals absent; labials and labellars numerous, scattered throughout.

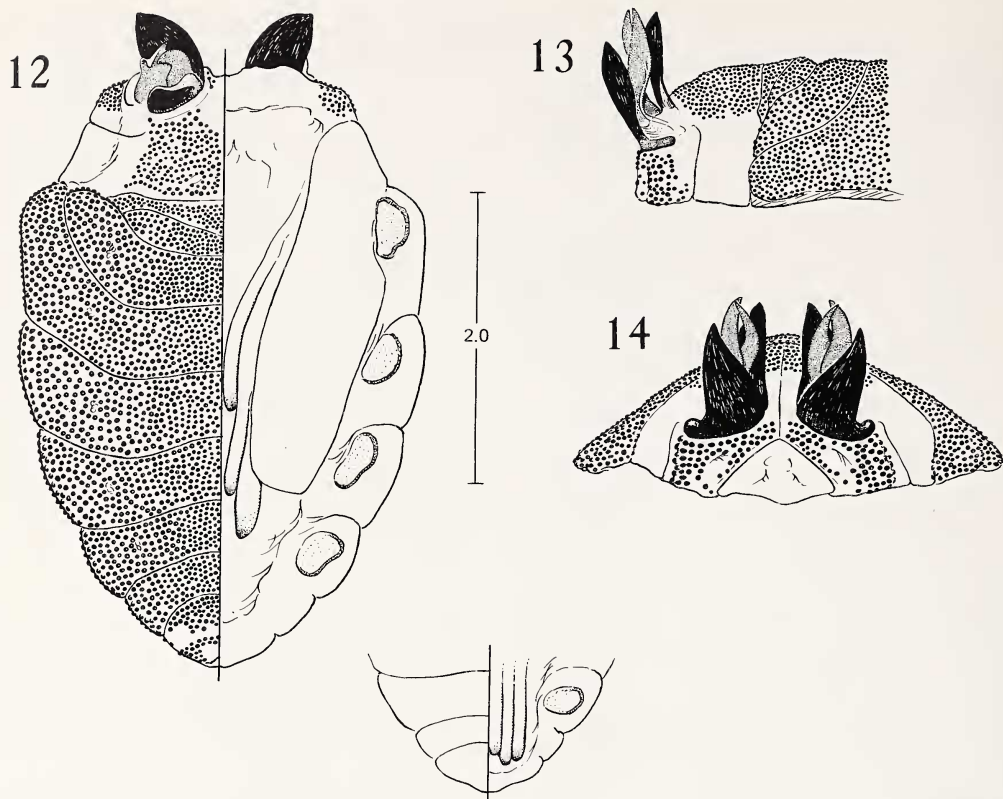
Thorax and Appendages (Fig. 6). Wing venation as in male. Anal angle of wing somewhat produced, a small lobe. Legs long and slender, femora incrassate, hind leg slightly stouter than others. Tibial spurs 0–0–0. Progressive proportions of leg segments: fore leg 1.1–0.4–0.5–0.7–1.0–1.2, mid leg 0.9–0.4–0.5–0.6–0.7–1.3, hind leg 0.9–0.4–0.4–0.5–0.7–1.2; tarsomeres 4 long in relation to 3 in all legs (1.0–0.7). Tarsomeres 5 similar in all legs, straight, with poorly developed pollex (basal group of only two to four heavy setae); claw sigmoid, simple (without subbasal tooth).

Sensilla. Setiform groups on thoracic sclerites as follows: acrostichals absent; dorso-central series complete; supraalars several (6), dorsal; prescutellars absent; scutellars numerous, generally distributed across sclerite, slightly more numerous laterad; preepisternals several (8), general; metapleurals several (6–9); suprametapleurals few (4–5).

Terminalia (Fig. 11). Sternite VIII well sclerotized throughout, base broad; lateral margin slightly convex, medial depression moderately deep, broadly V-shaped, margin sinuate, internal sclerotization narrow, Y-shaped; lobe broad, with truncate apex. Hypogynial plate complex, base narrower than distance between lobes of sternite VIII; lobe undivided and smooth with broad neck, apex minutely spicu-



Figures 7-11. *Paltostoma palominoi*, terminalia of adults. Male (dorsal views). 7. Inner view of right outer gonostylus. 8. Medial genital structures. 9. Cerci and inner arms. 10. Genital capsule and gonostyli. 11. Female (ventral view).



Figures 12-14. *Paltostoma palominoi*, pupa. 12. Entire male, with posterior portion of female inset to lower right (dorsoventral views). 13. Anterior portion (lateral view). 14. Anterior portion (frontal view).

late; interlobular area reflexed dorsally to form an elongate capsule. Sternite IX well defined, stirrup-shaped; tergite IX undefined. Spermathecae three in number, all large, pear-shaped, with short necks; moderately well sclerotized, outers equal and somewhat larger than central; duct of central much shorter than outers.

Sensilla. Sternite VIII with several medium setiforms distributed generally over lobe.

PUPA (Figs. 12-14). Integument. Border terminate, underfolded and ventrally sclerotized anteriorly only. Papillose dorsally. Papillae general on abdominal and thoracic tergites and on disc of scutum; present on branchial sclerite, these large and more dense posteriad. Abdominal papillae evenly spaced, somewhat disperse, more so laterad than mediad. Individual papillae moderately large, on abdominal tergites larger laterad (mean diameter 25.2 microns), grading to slightly smaller mediad (mean diameter 21.4 microns); scutal papillae about average in diameter. Thoracic papillae smooth, rounded, oval convexities, abdominal papillae minutely spinulate.

Size. Small for family. Measurements: male (N = 14): body length 3.2 (2.8-3.5), width 2.0 (1.8-2.3); female (N = 15): body length 3.7 (3.4-4.1), width 2.4 (2.1-2.8). Male 0.7 size of female.

General. Outline shape oviform, thorax abruptly narrowed. L/W male = 1.6, female 1.5. Anterior division small in relation to posterior division (HM/TA: male = 0.35, female = 0.33). Shape in cross section subtriangular, dorsoventrally depressed; sides slightly inclined. Dorsal sclerites: cephalic sclerite triangular, flat. Branchial sclerite narrow, planate. Anterior margin of scutum gradually inclined. Suture separating metathoracic from abdominal tergite I, angulate medially. Abdominal tergites smoothly convex middorsally (no medial ridges or nodes); lateral margins entire.

Branchiae. Erect; anterior and posterior plates rigid and heavily sclerotized; inner plates thin and semi-membranous. In frontal aspect, anterior plates divergent, middle pair appressed and parallel, their apices often overlapping, hind pair parallel. Base of anterior plate expanded posterolaterad to form a small bullate ridge. Anterior and posterior plates triangular, with acute and slightly curved apices; middle plates elongate, curved, with acute apices.

Ventral Sclerites. Cases of head appendages obscure; leg cases of female very unequal in length, apices uneven; apices of leg cases of male coterminate. Four adhesive disks (on abdominal segments III-VI).

LARVA (Fig. 15). General. Body form subonis-

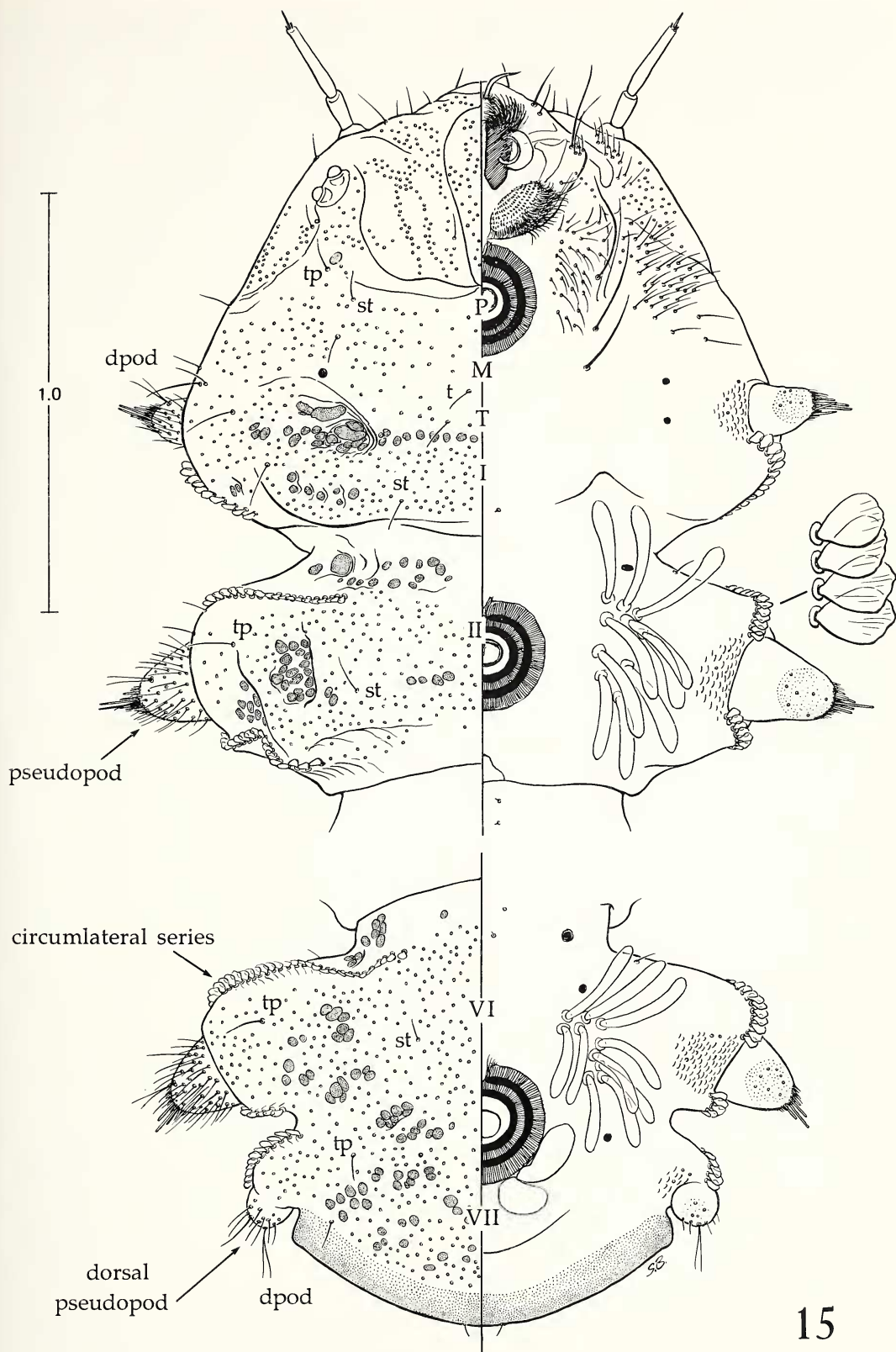


Figure 15. *Paltostoma palominoi*. Larva (dorsoventral view of anterior and posterior portions).

ciform. Medial elevated zones of abdominal segments not well defined. Outline shape of anterior division subhexagonal.

Integument. Dorsum moderately well sclerotized. Corrugations distinct, mostly irregular. Venter with area at bases of pseudopods lightly imbricate.

Coloration. Trunk pigmentation even, light brown; sclerotized portions pale brown, terminal border lightly pigmented.

Size. Medium for the family. Measurements (N = 11): body length 5.1 (4.5–5.7); head capsule width 1.2 (1.1–1.3); antennal segment lengths, basal 0.10 (0.08–0.11), apical 0.21 (0.20–0.24).

Head. Two distinctly separated lenses in eye. Antenna short, segment proportions 1.0–2.1.

Trunk. Dorsum of abdominal segments I–VI more or less evenly rounded, without convexities, projections, or large plates; numerous small plates on anal division and dorsolaterally on abdominal segments.

Anal Division. Dorsal pseudopod small, a nub, directed inward slightly. Terminal incision shallow. Terminal lobe broadly arcuate.

Primary Sensilla (medium setiforms unless otherwise described). tM–T oblique, tM medial to rT. stM–T slightly medial to line between tpP and tpM; stI–VI distant from rI–VI, tI–VI indiscernible, no PT tubercle. stVII and inner tp proximate. Inner tpP anteromedial to spiracle; inner tpI medial to homolog on M; inner tpII–VI set well anteriad. Outer tpI–VI indiscernible. Terminal setae 1–1, short chaetiforms.

Dorsal Modified Sensilla. Consist of minute, variously shaped projections (apparently oviform but barely visible and only slightly exceeding alveoli) in linear series and patches on head sclerites, and generally and evenly spaced on body integument. Circumlateral series complete, of foliose sensilla. Sensilla of pseudopods setiform generally, several truncate chaetiforms apically. Background field of fine setiforms absent.

SPECIMENS EXAMINED

TYPES. HOLOTYPE male (dissected and mounted on slides nos. CLH 89-38H, 89-38B, 89-38W, and 89-38M); ALLOTYPE female (dissected and mounted on slides nos. CLH 89-39H, 89-39B, 89-39W, and 89-39F). Deposited in Academia de Ciencias de Cuba, Santiago de Cuba. 1 male, 1 female PARATYPES [dissected and mounted on slides nos. CLH 89-5B, 89-5W, 89-5H, 89-5M (male), 89-6B, 89-6W, 89-6H, and 89-6F (female), from alcohol]. Deposited in Los Angeles County Museum of Natural History. 4 male, 4 female PARATYPES (teneral, extracted from pupal skins, dissected, and mounted on microscope slides). Deposited one pair each in British Museum of Natural History, London; United States National Museum, Washington, D.C.; Zoological Institute, Academy of Sciences,

Leningrad; American Museum of Natural History, New York: CUBA, *Santiago de Cuba Province*, Sierra Maestra, Río Palma Mocha, 700 meters, 23–24 February 1988, Gabriel Garcés.

ADDITIONAL SPECIMENS. 8 pharate male pupae, 7 pharate female pupae, 10 prepharate pupae, 120 larvae: same data as types. Deposited in British Museum of Natural History, London; United States National Museum, Washington, D.C.; Zoological Institute, Academy of Sciences, Leningrad; American Museum of Natural History, New York; Los Angeles County Museum of Natural History; Academia de Ciencias de Cuba, Santiago de Cuba.

DIAGNOSIS AND AFFINITIES

In northern South America and the Caribbean only the genera *Paltostoma* and *Limonicola* are recognized presently (Hogue and Bedoya, in press). Although it is still in a chaotic taxonomic state, with limits undefined, *Paltostoma* receives the new species at this time on the basis of the following synapomorphies: free inner gonostylus of the male terminalia (fused to aedeagal guide in *Limonicola*), elongate mouthparts of the adults of both sexes (vestigial in *Limonicola*), and well-developed circumlateral series of specialized dorsal setae in the larva (absent in *Limonicola*). We make this combination in spite of several similarities with *Limonicola*: male terminalia with large sperm sac and expansive ventral bridge, tendency toward colcephaly in the adult heads, pupa with base of anterior lamella expanded and subbullate, integument at base of pseudopods ventrally ornamented in larva rather than setose, and dorsal pseudopod VII moderately free of the terminal lobe.

In the Neotropical Region there are several species groups of *Paltostoma* that are known to Hogue but not yet formally recognized; their phylogenies are still being considered. On the basis of overall similarity, the new species is not closely related to any of those on the mainland, certainly not to that containing the type of the genus from South America or to those of Mexico or Central America, which have either lateral tines or a ventral plate in the male terminalia. The shape of the terminal lobe of the larva is of the same type as the species of Puerto Rico (*Paltostoma argyrocineta* Curran, 1927, and undescribed species), and the structures of the male terminalia are somewhat similar to those of that species (lack of ventral plate or lateral tines, simple broad aedeagal rods, broad sperm sac with armature). Also, the lateral entry of the vasa deferentia and spiculate inner gonostyli occur in the Cuban and Puerto Rican males and appear to be synapomorphies relating them. Thus, the new species seems most likely to have its sister species in Puerto Rico. (No blepharicerid is known from intervening Hispaniola despite an intensive search in suitable habitats there by Hogue in March of 1987.) *Paltostoma palominoi* clearly belongs to a distinct phyletic line

from the *P. schineri* group, which occupies the Lesser Antilles.

Paltostoma palominoi is readily recognized by well-defined characteristics in all stages: the most distinctive features in the male terminalia are the very large saccate piston with laterally emerging vasa deferentia and spiculate inner gonostylus. The lobes of the hypogynial plate in the female terminalia are uniquely simple, without either ornamentation or a secondary ventral sublobe. The proportions of the pupa are distinctive, the length of anterior division shorter relative to the posterior than in other species ($HM/TA = 0.35$; usually >0.5 in South American *Paltostoma*). The combination of the long antenna, imbricate integument ventrally at the base of the pseudopods, and general field of minute dorsal sensilla identifies the larva.

ZOOGEOGRAPHY

Blepharicerids are extremely poor dispersers with virtually no ability to cross large expanses of ocean. Thus, the occurrence of related species on Cuba and Puerto Rico suggests that these islands were connected, or located very close to each other, in the past. Also implied by this distribution is a connection of these islands with mainland South or Central America, because of the almost certain origin of the island species from continental ancestors.

These facts are in support of the "vicariance model" of Caribbean biogeography and recent plate tectonic studies of the area (Hedges, 1982). Furthermore, the new Cuban species' apparent restriction to the eastern end of the island lends some support to the hypothesis of separate origin of this portion from the larger central-western portion (Pregill, 1981). [A similar binary origin and subsequent accretion of the two parts is proposed for Hispaniola (Durham, 1985).] Isolation of this portion is also suggested by its recognition as a distinct "natural region" of high endemicity [e.g., for Trichoptera (Botosaneanu, 1977)].

ECOLOGY

Río Palma Mocha is located in a deep, well-forested valley between Pico Turquino and Palma Mocha Mountain, in the Sierra Maestra. The river heads on the north side of the former (highest peak in Cuba) and flows 13.5 km south from the cordillera to Sierra Maestra beach on the coast.

The immatures were found in typical blepharicerid microhabitats, the larvae only in shallow, clean, pollution-free water flowing rapidly over the vertical upper portions of large stones (30–60 cm diameter); the pupae were most numerous near the brinks of the same falls. Immatures were absent from submerged stones at the base of the falls. Water temperature at the collecting site ranged from

18 to 20°C. No free-flying adults were seen, but four mature adult specimens (including the holotype) were collected from a spider's web situated between rocks at the edge of the stream.

ETYMOLOGY

The species is named in honor of José Palomino Oliva, a kind and hard-working Cubano, who has contributed in many ways to the development of studies on the flora and fauna of the Río Palma Mocha area of the Sierra Maestra.

REMARKS

Association of the stages as described here is certain, determined by the "ontogenetic method" (examination of the pharate succeeding stage within the skin of the preceding; Hogue and Bedoya, in press). By analogy with the situation in Puerto Rico, a much smaller island than Cuba, the possibility exists that additional species of the family may be found here.

ACKNOWLEDGMENTS

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